

NEW ENGLAND *CAREX* (CYPERACEAE):
TAXONOMIC PROBLEMS AND
PHYTOGEOGRAPHICAL CONSIDERATIONS

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ABSTRACT

Carex, the largest genus of flowering plants in New England, has long presented systematists and floristicians with difficulties. An update on recent systematic research of New England *Carex* is presented and persisting areas of taxonomic difficulty are tabulated. Whether a species is northern or southern in overall distribution with respect to New England is suggested to be significant, with northern species more frequently persisting as isolated occurrences and under more threat than southern species.

Key Words: *Carex*, New England, phytogeography

INTRODUCTION

With about 185 species (Seymour, 1982), *Carex* is the largest genus of vascular plants in New England. Sedges are an important element of most terrestrial communities throughout New England and are prominently represented in rare, threatened, and endangered species lists for all the New England states. However, the large size and taxonomic complexity of the genus make it a difficult one to deal with floristically. Many species are distinguished by small and subtle differences and, within certain groups, the systematics are poorly understood. In New England these difficulties are somewhat counter-balanced by the long history of collection and study of *Carex* by eminent caricologists beginning with Chester Dewey, Edward Tuckerman, and Francis Boott and continuing on into the 20th century with systematists such as M. L. Fernald. As an aside, the early studies of *Carex* in New England mean that many New England species, nearly 20% in fact, have their type locality in New England, thus adding to the desirability of protecting New England populations of these species.

While taxonomic problems can rarely be effectively solved by research confined to a local area, close study of a region can certainly lead to insights useful in studies over the entire range of a species. Also, since the particular combination of species in a region is usually unique, local areas may offer opportunities for studying the interactions of certain species.

This paper aims to outline known problem taxa in New England

Table 1. Recent research altering the status of New England *Carex* (excluding putative New England endemics).

Treatment in Seymour (1982)	Revised Treatment	Reference
<i>C. convoluta</i>	<i>C. rosea</i>	Webber and Ball, 1984
<i>C. rosea</i>	<i>C. radiata</i>	Webber and Ball, 1984
<i>C. radiata</i>	<i>C. appalachica</i>	Webber and Ball, 1984
<i>C. howei</i>	<i>C. atlantica</i> subsp. <i>capillacea</i>	Reznicek and Ball, 1980
<i>C. incompta</i>	<i>C. atlantica</i> subsp. <i>atlantica</i>	Reznicek and Ball, 1980
<i>C. cephalantha</i>	<i>C. echinata</i> subsp. <i>echinata</i>	Reznicek and Ball, 1980
<i>C. angustior</i>	<i>C. echinata</i> subsp. <i>echinata</i>	Reznicek and Ball, 1980
<i>C. pennsylvanica</i> var. <i>distans</i>	<i>C. lucorum</i>	Crins and Ball, 1983a
<i>C. crinita</i> var. <i>gynandra</i>	<i>C. gynandra</i>	Standley, 1983; Bruederle and Fairbrothers, 1986
<i>C. walteriana</i>	<i>C. striata</i>	Reznicek and Catling, 1986

Carex, note ongoing work on the genus, and note relevant recently published work. As such, it provides an update to Seymour (1982). New England is quite well collected, and this paper hopefully will also focus attention of field botanists and students on problematic groups and stimulate thoughtful collecting in those areas where most good can be done. Putative New England endemics are briefly discussed, and a few overlooked aspects of biogeography relevant to conservation are noted.

SYSTEMATIC PROBLEMS

Table 1 provides an update to Seymour (1982) for those native species of *Carex* for which detailed published treatments clarify New England species. Treatments which resulted neither in nomenclatural corrections nor taxonomic realignments at the species level are not included nor are minor nomenclatural adjustments such as changes in author citations. Unpublished theses also are not cited.

Table 2 attempts to outline taxonomic problems that have not yet been resolved in full, published treatments. If an abstract, thesis, or partial treatment is available, it is cited. The funda-

Table 2. Problematic *Carex* taxa without complete published revisions.

Treatment in Seymour (1982)	Recent Alternative Treatments	Available Literature or Data Source
1. Problems with circumscription of species		
<i>C. tincta</i> <i>C. normalis</i>	<i>C. tincta</i> not recognized by Gleason and Cronquist (1963); suggested to be a hybrid	
<i>C. albolutescens</i>	<i>C. longii</i> segregated by Fernald (1950)	P. E. Rothrock (pers. comm.)
<i>C. brevior</i> <i>C. molesta</i> <i>C. merritt-fernaldii</i>	Only <i>C. brevior</i> recognized by Gleason and Cronquist (1963); <i>C. molesta</i> suggested to be a hybrid	J. M. Webber (pers. comm.)
<i>C. umbellata</i> <i>C. abdita</i> <i>C. tonsa</i>	Only <i>C. umbellata</i> recognized by Gleason and Cronquist (1963); nomenclature in doubt—cf. Mackenzie (1935) and Fernald (1950)	Rettig (1987)
<i>C. aurea</i> <i>C. garberi</i>	Only <i>C. aurea</i> recognized by Boivin (1979)	P. W. Ball (pers. comm.), Katz et al. (1986)
<i>C. granularis</i>	<i>C. haleana</i> and <i>C. granularis</i> recognized by Mackenzie (1935)	
<i>C. katahdinensis</i> <i>C. conoidea</i>	<i>C. katahdinensis</i> recognized only as forma by Boivin (1967)	R. Naczi (pers. comm.)
2. Problems with ranks of taxa otherwise circumscribed similarly by authors		
<i>C. cephalophora</i> <i>C. mesochorea</i>	<i>C. cephalophora</i> var. <i>mesochorea</i> (Gleason and Cronquist, 1963)	
<i>C. muhlenbergii</i> var. <i>muhlenbergii</i> var. <i>enervis</i>	<i>C. muhlenbergii</i> <i>C. plana</i> (Mackenzie, 1932)	
<i>C. cephaloidea</i> <i>C. sparganioides</i>	<i>C. sparganioides</i> var. <i>cephaloidea</i> (Gleason and Cronquist, 1963)	
<i>C. annectens</i> var. <i>xanthocarpa</i>	<i>C. brachyglossa</i> (Mackenzie, 1932)	

Table 2. Continued.

Treatment in Seymour (1982)	Recent Alternative Treatments	Available Literature or Data Source
<i>C. tribuloides</i> <i>C. projecta</i>	<i>C. tribuloides</i> var. <i>reducta</i> (Boivin, 1979)	J. M. Webber (pers. comm.)
<i>C. straminea</i> <i>C. hormathodes</i>	<i>C. straminea</i> var. <i>invisa</i> (Gleason and Cronquist, 1963)	
<i>C. aenea</i> <i>C. argyrantha</i>	<i>C. argyrantha</i> var. <i>aenea</i> (Boivin, 1979)	
<i>C. peckii</i> <i>C. emmonsii</i> <i>C. artitecta</i> <i>C. nigromarginata</i>	<i>C. nigromarginata</i> with four varieties (Gleason and Cronquist, 1963)	Rettig (1987)
<i>C. lasiocarpa</i> <i>C. lanuginosa</i>	<i>C. lasiocarpa</i> var. <i>latifolia</i> (Gleason and Cronquist, 1963)	
<i>C. debilis</i>	<i>C. debilis</i> <i>C. flexuosa</i> (Mackenzie, 1935)	Waterway (1987a, 1987b)
<i>C. amphibola</i>	<i>C. grisea</i> <i>C. amphibola</i> (Mackenzie, 1935)	R. Naczi (pers. comm.)
<i>C. tetanica</i> <i>C. woodii</i>	<i>C. tetanica</i> var. <i>woodii</i> (Gleason and Cronquist, 1963)	
<i>C. albursina</i> <i>C. laxiflora</i> <i>C. striatula</i> <i>C. blanda</i> <i>C. gracilescens</i> <i>C. ormostachya</i> <i>C. leptonervia</i>	<i>C. laxiflora</i> with 6 varieties (Gleason and Cronquist, 1963); <i>C. leptonervia</i> also submerged as a variety by Boivin (1979)	Bryson (1980), Manhart (1986)
<i>C. flava</i> <i>C. viridula</i>	<i>C. flava</i> <i>C. cryptolepis</i> <i>C. laxior</i> (Mackenzie, 1935)	Crins (1985), Crins and Ball (1983b, 1988)
<i>C. vesicaria</i>	<i>C. vesicaria</i> <i>C. mainensis</i> <i>C. raeana</i> (Mackenzie, 1935)	

mental criterion for constructing this Table was disagreement about circumscription or rank of taxa among recent authors. A wide range of problems are thus included, from fundamental disagreements about distinctness and relationship to minor philosophical quibbles about rank of taxa otherwise circumscribed identically. A large number of varietal names are attributed to species of New England *Carex*. In some cases, these have proven to be significant and are here considered. In the majority of cases, these are simply subdivisions of continuous variation with little or no geographic segregation and are not included. Again, minor nomenclatural disagreements are not included, nor are difficult complexes with only one species in New England, or hybrids, unless these have been treated as species by some authors.

The information in Table 2 can be readily gleaned from the literature. However, presentation of it all together illustrates powerfully the substantial degree of disagreement and the magnitude of work left to be done. Of course, the fact that it is possible to draw up such a list as Table 2 is really a testimony to how well known the flora is. At least the problem areas are known! Naturally, this table is also not necessarily complete. One cannot easily anticipate problems such as unrecognized cryptic species nor precisely predict range extensions of members of problem groups into New England.

Fully 46 species, about 25%, of New England *Carex* are involved in taxonomic disagreements among recent authors, a somewhat startling statistic considering that the New England flora is traditionally considered to be well understood. Of course, many of these disagreements are minor, and thorough revision may not result in substantial changes to the taxonomic status of many species.

NEW ENGLAND ENDEMIC

Three species of *Carex* have been generally considered to be endemic to New England: *C. elachycarpa*, *C. josselynii*, and *C. oronensis*. The first two species were studied by Reznicek and Ball (1979). *Carex elachycarpa* was demonstrated merely to be a variant of the eastern North American calciphile *C. sterilis*. *Carex josselynii* was more of a puzzle, but was referred, with some hesitation, to *C. echinata*. The recent discovery of plants with morphology similar to *C. josselynii* in the St. John River system

in adjacent New Brunswick (Hinds, 1986) has prompted continued recognition of the plant as a species. More work is needed here.

Carex oronensis Fern. in sect. *Ovales* is still an unsolved puzzle, but work by Allison Dibble (pers. comm., 1988) should soon resolve the problem.

PHYTOGEOGRAPHICAL CONSIDERATIONS

A detailed phytogeographic analysis of such a large group of plants as New England *Carex* is beyond the scope of this brief article. Indeed, it could be the subject of a large paper on its own (Raymond, 1951). A few aspects where phytogeography may directly impinge on conservation of and research on rare species are, however, here noted.

Knowing plant distributions and habitats, both within New England and in adjoining areas, greatly aids in discovering the precise status of rare species in each state. It can even point to probable additions as yet undiscovered, such as the northwestern *Carex sychnocephala* which occurs in Quebec very close to Vermont (Rousseau, 1974), and the boreal *C. concinna* and *C. rostrata sensu stricto* (Reznicek, 1985) which occur close to the Maine border in New Brunswick (Hinds, 1986). A number of New England's rarer *Carex* are western or northwestern calciphiles, including such species as *C. sterilis*, *C. richardsonii*, *C. atherodes*, and *C. molesta*, and knowledge of their distribution and ecology can help pinpoint occurrences of rare habitats.

As implied in the previous paragraph, rare species in a given area are quite frequently species at the edges of their ranges. Biologically it may not make sense to be concerned about a species in a particular area if it is common in adjacent regions. This overlooks both the need to work within political boundaries due to legislation and the obligation of each state to protect its own natural heritage. In addition, marginal populations of species are frequently somewhat genetically differentiated.

There may also be some relevance to whether or not a species is northern or southern in distribution with respect to New England. With minor fluctuations, vegetational changes in New England after de-glaciation have primarily involved gradual displacement to the north and to higher elevations of boreal and arctic-alpine species by deciduous forest species from the south.

Northern species now mostly persist as more or less disjunct occurrences in small pockets of cooler habitats, including such sites as springy seeps, alpine areas, conifer swamps, cliffs and exposed headlands, deep ravines, shores of large lakes and rivers, etc. Although there are exceptions, many southern species, by contrast, now have ranges that stop relatively abruptly, with fewer isolated, disjunct occurrences. This trend can be relatively easily detected by comparing distributions of northern and southern species in a mapped flora such as that for Michigan (Voss, 1972, 1985).

The practical consequence of this is that if a northern species is lost from a site, not only is there likely not to be a nearby site producing propagules for recolonization, but suitable habitat is restricted to tiny pockets. Many rare southern species may have occurrences relatively nearby from which recolonization may occur if a species is lost from a site—even if the occurrences are on the other side of the state line. Available habitat is also not necessarily restricted to tiny pockets.

This point is of particular relevance to *Carex*, since the genus is so important in arctic-alpine and boreal regions. About 13% of New England *Carex* are boreal or arctic-alpine, including such restricted species as *C. capitata*, *C. capillaris*, *C. livida*, *C. media*, *C. saxatilis*, *C. rariflora*, and *C. vaginata*. However, northern species of *Carex* are disproportionately represented in rare plant lists for New England, constituting nearly 40% of the species in the list compiled by Crow et al. (1981). And, based on the considerations noted above, I would also predict that relatively fewer new stations and major range extensions will be found in the future for northern species as contrasted with southern species.

CONCLUSIONS

Considering how well known the systematics of New England plants is generally thought to be, a surprising 25% of the *Carex* are involved in taxonomic controversy. More research is clearly needed, but resolution of these problem areas does require revisionary work beyond the boundaries of New England, so as to include the entire ranges of the species or species complexes. Dealing in the meantime with unrevised groups obviously presents a problem. Fortunately, only a minority of problem groups include rare species. Primarily for the sake of information gath-

ering, it is probably best to be a “splitter” until evidence to the contrary is convincing. It is easy to join two sets of data into one, but it may be impossible to split data. This approach may lessen the upheavals in rare plant treatments that might otherwise happen when the taxonomy of a group is resolved.

Just as knowing a species' biology is the key to protecting it, so knowing accurately species systematics, geographical distribution, and abundance is the key to knowing what to protect. While solving systematic problems will take time, study of the regional distribution and abundance of species is both feasible in the short term and worthwhile. When a real effort has been made to study plants in the field, it is surprising how often information gleaned from herbaria has been misleading or wholly unrepresentative.

Some biogeographical factors, such as disjunctions of stations, the overall abundance and range of species and whether or not the species is endemic are taken into account routinely in conservation of rare species. An additional factor to be considered is whether or not the species is of southern or northern affinity with respect to a particular area, northern species being potentially more threatened.

LITERATURE CITED

- BOIVIN, B. 1967. Énumération des plantes du Canada VI—monopsides (2ème partie). *Naturaliste Canad.* 94: 471–528.
- . 1979. Flora of the prairie provinces, part IV. *Phytologia* 43: 1–106.
- BRUEDERLE, L. P. AND D. E. FAIRBROTHERS. 1986. Allozyme variation in populations of the *Carex crinita* complex (Cyperaceae). *Syst. Bot.* 11: 583–594.
- BRYSON, C. T. 1980. A revision of the North American *Carex* section *Laxiflorae* (Cyperaceae). Ph.D. thesis, Mississippi State University.
- CRINS, W. J. 1985. The taxonomy of *Carex* section *Ceratocystis* in North America and northern Europe. Ph.D. thesis, University of Toronto.
- AND P. W. BALL. 1983a. The taxonomy of the *Carex pensylvanica* complex (Cyperaceae) in North America. *Canad. J. Bot.* 61: 1692–1717.
- AND ———. 1983b. Revisionary studies in *Carex* section *Extensae*: preliminary results. (Abstr.) *Amer. J. Bot.* 70: 110.
- AND ———. 1988. Sectional limits and phylogenetic considerations in *Carex* section *Ceratocystis* (Cyperaceae). *Brittonia* 40: 38–47.
- CROW, G. E., W. D. COUNTRYMAN, G. L. CHURCH, L. M. EASTMAN, C. B. HELLQUIST, L. L. MEHRHOFF AND I. M. STORKS. 1981. Rare and endangered vascular plant species in New England. *Rhodora* 83: 259–299.
- FERNALD, M. L. 1950. *Gray's Manual of Botany*, 8th ed. Amer. Book Co., New York.
- GLEASON, H. A. AND A. CRONQUIST. 1963. *Manual of the Vascular Plants of*

- Northeastern North America and Adjacent Canada. Van Nostrand Reinhold Co., New York.
- HINDS, H. R. 1986. The Flora of New Brunswick. Primrose Press, Fredricton, New Brunswick.
- KATZ, D. S., E. G. VOSS AND J. MCNEILL. 1986. A taxonomic investigation of *Carex aurea* Nutt. and *Carex garberi* Fern. (section *Bicolores*) in Emmet and Chippewa Counties, Michigan. (Abstr.) Amer. J. Bot. 73: 770.
- MACKENZIE, K. K. 1932. Cyperaceae-Cariceae. N. Amer. Fl. 18: 1-168.
- . 1935. Cyperaceae-Cariceae. N. Amer. Fl. 18: 169-478.
- MANHART, J. R. 1986. Foliar flavonoids of the North American members of *Carex* section *Laxiflorae* (Cyperaceae). Biochem. Syst. Ecol. 14: 85-90.
- RAYMOND, M. 1951. Sedges as material for phytogeographical studies. Mém. Jard. Bot. Montréal 20: 1-23.
- RETTIG, J. 1987. Foliar flavonoids of the *Carex pensylvanica* group (section *Montanae*, Cyperaceae) in North America. (Abstr.) Amer. J. Bot. 74: 749.
- REZNICEK, A. A. 1985. What is *Carex rostrata* Stokes? (Abstr.) Amer. J. Bot. 72: 966.
- AND P. W. BALL. 1979. The status of two New England "endemic" carices: *Carex elachycarpa* and *C. josselynii* (Cyperaceae). Taxon 28: 217-223.
- AND ———. 1980. The taxonomy of *Carex* section *Stellulatae* in North America north of Mexico. Contr. Univ. Mich. Herb. 14: 153-203.
- AND P. M. CATLING. 1986. *Carex striata*, the correct name for *C. walteriana* (Cyperaceae). Rhodora 88: 405-406.
- ROUSSEAU, C. 1974. Géographie Floristique du Québec-Labrador. Les Presses de l'Université Laval, Québec.
- SEYMOUR, F. C. 1982. The Flora of New England, 2nd ed. Phytologia Memoirs V.
- STANDLEY, L. A. 1983. A clarification of the status of *Carex crinita* and *C. gynandra* (Cyperaceae). Rhodora 85: 229-241.
- VOSS, E. G. 1972. Michigan Flora. Part I. Gymnosperms and Monocots. Bull. Cranbrook Inst. Sci. 55 and University of Michigan Herbarium.
- . 1985. Michigan Flora. Part II. Dicots (Saururaceae to Cornaceae). Bull. Cranbrook Inst. Sci. 59 and University of Michigan Herbarium.
- WATERWAY, M. J. 1987a. Allozyme variation within *Carex* section *Sylvaticae*. (Abstr.) Canad. Bot. Assoc. Bull. 20: 16.
- . 1987b. Evolutionary relationships in *Carex* sect. *Sylvaticae*: evidence from allozymes, chromosomes and morphology. XIV International Botanical Congress Abstracts.
- WEBBER, J. M. AND P. W. BALL. 1984. The taxonomy of the *Carex rosea* group (section *Phaestoglochin*) in Canada. Canad. J. Bot. 62: 2058-2073.

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